

Claims

I claim:

- 1 1. A method for locating a mobile node in a partially synchronized wireless
- 2 network, comprising:
- 3 measuring a first time interval to transmit a first message from a first
- 4 stationary node at a first known location to a mobile node at an unknown
- 5 location;
- 6 measuring a second time interval to transmit a second message from a
- 7 second stationary node at a second known location to the mobile node, in
- 8 which the first stationary node is time synchronized with the second
- 9 stationary node;
- 10 measuring a first received signal strength of a third message
- 11 transmitted by the mobile node to a third stationary node at third known
- 12 location;
- 13 measuring a second received signal strength of the third message
- 14 transmitted by the mobile node to a fourth stationary node at fourth known
- 15 location;
- 16 determining a first set of possible coordinates of the mobile node from
- 17 the first time interval and the second time interval;
- 18 determining a second set of possible coordinates of the mobile node
- 19 from the first received signal strength;
- 20 determining a third set of possible coordinates of the mobile node
- 21 from the second received signal strength; and
- 22 intersecting the first, second and third sets of possible coordinates of
- 23 the mobile node to estimate a location of the mobile node.

- 1 2. The method of claim 1, in which each node includes a unique
2 identification, and each message includes a unique serial number.
- 1 3. The method of claim 1, in which the mobile nodes are sensor nodes in an
2 ad hoc wireless network.
- 1 4. The method of claim 1, in which the messages are transmitted in response
2 to a locate request message identifying the mobile node.
- 1 5. The method of claim 1, in which the first set of possible coordinates is a
2 solution set of a hyperbolic function.
- 1 6. The method of claim 1, in which the first and second set of possible
2 coordinates are solution sets of circular functions.
- 1 7. The method of claim 1, in which a communication range of the mobile
2 node is substantially less than a transmit communication range of the
3 stationary nodes.
- 1 8. A system for locating a mobile node in a partially synchronized wireless
2 network, comprising:
3 a mobile node at an unknown location configured to obtain a first time
4 interval to transmit a first message from a first stationary node at a first
5 known location to the mobile node and a second time interval to transmit a
6 second message from a second stationary node at a second known location

7 to the mobile node, in which the first stationary node is time synchronized
8 with the second stationary node;
9 a third stationary node at a third known location configured to
10 measure a first received signal strength of a third message transmitted by the
11 mobile node;
12 a fourth stationary node at a fourth known location configured to
13 measure a second received signal strength of the third message transmitted
14 by the mobile node;
15 means for determining a first set of possible coordinates of the mobile
16 node from the first time interval and the second time interval, a second set of
17 possible coordinates of the mobile node from the first received signal
18 strength, and a third set of possible coordinates of the mobile node from the
19 second received signal strength; and
20 means for intersecting the first, second and third sets of possible
21 coordinates of the mobile node to estimate a location of the mobile node.